

## **AMENDMENTS TO THE CLAIMS**

1. (Currently amended) A fluidized bed reactor for chlorinating zirconium and rutile sands, i.e., reactant materials, to produce metals such as zirconium, hafnium and titanium comprising:

a hollow, elongated, vertically oriented reactor housing for confining a reaction of the ~~raw~~reactant materials as they are transformed, a portion of the reactor housing confining the reaction of the ~~raw~~reactant materials defining a reaction zone;

a central chlorine gas or chlorine gas and ~~solids~~reactant materials inlet proximate the bottom of the reaction zone within the housing for directing chlorine gas or chlorine gas and ~~solids~~reactant materials in an upward direction along the vertical axis of the housing into the reaction zone without passing through a solid or perforated diffuser section to maintain the ~~raw~~reactant materials in suspension;

a plurality of peripheral chlorine gas inlet jets positioned at at least two elevations along the elongated dimension of the housing for introducing chlorine gas at an angle to the elongated dimension of the housing to promote mixing of the ~~raw~~reactant materials in suspension;

a plurality of control valves in fluid communication with a fluidizing chlorine gas supply and respective ones of the plurality of peripheral chlorine gas inlet jets for individually controlling the quantity of chlorine gas passing through the respective plurality of peripheral chlorine gas inlet jets;

a residue collection housing mating at one end with a lower portion of the reactor housing at the bottom of the reaction zone in fluid communication with the reaction zone and having an inclined lower wall for directing a reaction process residue from the reaction zone to a residue collection port through which the residue is extracted from the fluidized bed reactor; and

a sparger including a plurality of chlorine gas orifices positioned around at least a portion of the circumference of the interior of the residue collection housing and below the central chlorine gas or chlorine gas and ~~solids~~reactant materials inlet for introducing chlorine gas within the residue collection housing to maintain reaction process residue below a given size in suspension and directed back into the reaction zone while enabling agglomerates of reaction process residue above the given size to drop towards the collection port;

wherein the sparger chlorine gas orifices, the plurality of peripheral chlorine gas inlet jets and the central chlorine gas or chlorine gas and ~~solids~~reactant materials inlet are sized so the volume of chlorine gas emitted by each is a fixed predetermined ratio that maintains good

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active mixing, minimizes defluidization of the reaction products and promotes reaction of the reactant materials within the reaction zone.

2. (Currently amended) The fluidized bed reactor of claim 1 wherein the reactor housing has a conical section circumscribing the reaction zone with the reduced diameter of the conical section at its lower end interfacing with the chlorine gas or chlorine gas and ~~solids~~reactant materials inlet.

3. (Cancelled)

4. (Previously amended) The fluidized bed reactor of claim 1 including a feeder positioned at the residue collection port for removing the residue from the collection housing.

5. (Original) The fluidized bed reactor of claim 4 wherein the feeder is a screw or rotary feeder.

6. (Original) The fluidized bed reactor of claim 4 wherein the feeder continuously removes the residue from the reactor during operation.

7. (Cancelled)

8. (Currently amended) The fluidized bed reactor of claim 1 wherein the sparger ~~chlorine gas orifices are introduced at a downwardly directed~~ directed at a downward angle to the central axis of the collection housing.

9. (Previously amended) The fluidized bed reactor of claim 1 wherein the incline of the lower wall of the residue collection housing is designed so that the gravitational forces on the residue above the given size will overcome the wall friction and travel to the collection port.

10. (Previously amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are directed at a downward angle to a line perpendicular to the central axis of the reactor housing.

11. (Cancelled)

12. (Currently amended) The fluidized bed reactor of claim 1 wherein the central chlorine gas or chlorine gas and ~~solids~~reactant materials inlet, the plurality of peripheral chlorine gas inlet jets and sparger are structurally formed so that approximately 30% of a fluidizing chlorine gas is introduced through the central chlorine gas or chlorine gas and ~~solids~~reactant materials inlet, approximately 65% of the fluidizing chlorine gas is introduced through the plurality of peripheral chlorine gas inlet jets, and 5% of the fluidizing chlorine gas is introduced through the sparger.

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13. Cancelled
14. (Previously amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets includes a plurality of chlorine gas jets at each of said elevations respectively positioned around the circumference of the reactor housing.
15. (Previously amended) The fluidized bed reactor of claim 14 wherein the plurality of peripheral chlorine gas inlet jets at each elevation are equidistantly positioned around the circumference of the reactor housing.
16. (Previously amended) The fluidized bed reactor of claim 14 wherein the plurality of peripheral chlorine gas inlet jets at each elevation are not aligned with the jets at the other elevations.
17. (Original) The fluidized bed reactor of claim 4 wherein the feeder removes the residue from the reactor in batches during operation.
18. (Previously amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are positioned at at least three elevations.
19. (Previously amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are structurally formed so that the pressure drop across the plurality of peripheral chlorine gas inlet jets is at least 30% of the pressure drop across the reaction zone.
20. (Previously amended) The fluidized bed reactor of claim 1 wherein the sparger is structurally formed so that the pressure drop across the sparger is at least thirty percent of the pressure drop across the reaction zone.
21. (Previously added) The fluidized bed reactor of Claim 1 wherein the reactor housing comprises graphite.

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